

Remarks

Claims 1 and 3-44 are pending.

Rejections under 35 U.S.C. § 103

Claims 1, 3-5, 7-8, 11-12, 15-25, 27-28, 31-32, and 35-44 were rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 6,261,469 to Zakhidov et al. (hereinafter "Zakhidov"). Claims 6 and 26 were rejected under 35 U.S.C. § 103(a) as obvious over Zakhidov in view of U.S. Patent Application Publication No. 2003/0006534 to Taboas et al. (hereinafter "Taboas"). Claims 9-10, 13-14, 29-30, and 33-34 were rejected under 35 U.S.C. § 103(a) as obvious over Zakhidov in view of Taboas and further in view of U.S. Patent No. 5,980,813 to Narang et al. (hereinafter "Narang"). The rejections are respectfully traversed for the reasons articulated below.

The Rejection Is Not Based on Proper Legal Standards.

A proper *prima facie* case of obviousness has not been made. The Office Action indicates that Zakhidov has not been considered for all that it teaches, since disclosures therein that plainly teach away from Applicants' claimed methods appear to have been ignored without proper basis. When applying 35 U.S.C. § 103, "the following tenets of patent law must be adhered to: (A) The claimed invention must be considered as a whole; (B) The references *must be considered as whole* and must suggest the desirability and thus the obviousness of making the combination." Hodosh v. Block Drug Co., 786 F.2d 1136, 1143 n. 5 (emphasis added). Furthermore, "[a]ll evidence bearing on the issue of obviousness... must be considered and evaluated **before** the required legal conclusion is reached. W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 1555. Thus, "[a] prior reference must be considered in its entirety,

i.e. as a whole, **including portions that would lead away from the claimed invention.**”

M.P.E.P. § 2141.02 [VI] (emphasis added).

Applicants’ Claimed Methods

Applicants’ claimed methods provide for the *precise* shrinkage of a bicontinuous or multicontinuous structure (page 7, lines 23-25). “The shrinkage of a template material results alternatively in the inverse or the original (direct) structure and after each process cycle, the structures possesses smaller sample dimensions while replicating the *precise* complementary structure of each precursor” (page 8, lines 10-13, emphasis added). Claim 1 specifically requires *infiltrating* the *shrunk* inverse replica. This is necessary in order to obtain a replica of the the inverse replica and to be able to repeat/cycle the process for further shrinkage.

Applicants’ process enables both substantial shrinkage and high template fidelity. In contrast, one skilled in the art would appreciate that when most materials are heated to drive off mass and thereby shrink the material, the material tends to crack and distort from the stresses. Fidelity of features in the replica or inverse replica is thus lost.

Zakhidov

Zakhidov primarily teaches infiltrating an exact inverse replica of material B with a material C, and then removing the material B to create a *direct* replica of material C (Col. 7, Lns. 14-21). It teaches away from a process that includes making a shrunk inverse replica, *and* infiltrating that shrunk inverse replica with a fluid material, *and* then immobilizing that fluid material, as required by claim 1.

*Zakhidov's Disclosed Process for Shrinking Would Render
Applicants' Claimed Process Inoperable.*

Zakhidov does not suggest *infiltrating* a *shrunk* inverse replica, because Zakhidov teaches a process that one skilled in the art would understand is inoperable if adopted for use in Applicants' claimed methods. In particular, the process in Zakhidov which discloses contraction (Col. 17, Lns. 40-67; Example 7) results in glassy *carbon* this is totally unsuitable for repeating/cycling. The final pyrolysis step "up to about 1000 °C or higher" results in essentially a pure carbon material that, even if one were to infiltrate pores therein with a resin or other material, would not be removable from the resin.

The shrunken carbon structure taught by Zakhidov is effectively a "dead end" and would be inoperable as the isotropically shrunken inverse replica in Applicants' claimed cyclical process. One skilled in the art therefore would not be led to include the further step of infiltration of the inverse *shrunk* replica as required by Applicants' claims 1, or to remove the immobilized material that comprises the bi- or multi-continuous structure of the inverse shrunken replica as required by Applicants' claim 3.

Zakhidov Teaches That Shrunk Replicas Are Unsatisfactory and Imperfect.

One of ordinary skill in the art would undoubtedly understand that Zakhidov *when read as a whole* teaches that it is undesirable to make replicas that shrink, because those processes yield inferior inverse copies that do not possess the required fidelity to be considered exact replicas. There is no suggestion that Zakhidov's process will yield an *isotropically* shrunken replica. One skilled in the art therefore could not and would not have any motivation to further use those inverse replicas to make further replicas. Accordingly, one of ordinary skill in the art

would be led away from further infiltrating those unsatisfactory shrunken inverse replicas and would not repeat the process to get multiple shrinkage. To do so would only compound the loss of fidelity.

At Col. 1, Ln. 66 to Col. 2, Ln. 64, Zakhidov discusses how “[t]he lack of success in prior research reflects several generic issues.” One is that “the unsolved problem still remains of conducting such extraction of a high-thermal-stability matrix material (like SO₂) without disrupting the structure of the infiltrated material.” Zakhidov provides examples of such prior research, including (1) a method by Velev et al. “causing 20-35% shrinkage,” (2) a method by Wijnhoven and Vos “providing 33% shrinkage,” and (3) a method by B.T Holland et al. that is “quite similar.” Zakhidov then specifically teaches why these methods are undesirable:

Such processes can avoid the above topological problems by using holes in the reacting coating layer (or layer permeability) to permit release of the gases produced by pyrolysis. However, this approach is *generally unsatisfactory* because of [eight enumerated reasons including] (4) the occurrence of about 20-35% shrinkage of lattice parameter of the final structure relative to the initial structure, which can *disrupt* structural perfection.

Column 2, lines 34-45 (emphasis added).

As Zakhidov states that shrunken replicas, as opposed to exact replicas, are unsatisfactory and imperfect, one of skill in the art would have been completely unmotivated to infiltrate the *shrunken* inverse replica of Zakhidov to produce a *further shrunken* direct replica. It is improper for the Examiner to ignore Zakhidov’s evidence of teaching away, while simultaneously relying on Zakhidov’s bare disclosure of making a *carbon* inverse opal that has a 20 to 25% contraction.¹ As Zakhidov suggests that shrunken replicas, as opposed to exact replicas, are

¹ The Examiner’s attempt to partition the negative disclosure in Zakhidov as belonging only to a quote from B.T.

unsatisfactory and imperfect, one of ordinary skill in the art would have been unmotivated to infiltrate the *shrunk* inverse replica of Zakhidov to produce a further shrunk replica.

For these reasons, no *prima facie* case of obviousness of Applicants' claims has been established in view of Zakhidov.

Zakhidov in Combination with Taboas

Taboas is directed to the fabrication of a porous mold that is used to cast scaffolds that are used as tissue regeneration platforms.

As a preliminary matter, Taboas and Zakhidov are from non-analogous arts, and the Examiner has identified no reason why one of skill in the arts familiar with Zakhidov would have had any motivation to look to Taboas. One of ordinary skill in the art would appreciate that structures for tissue regeneration generally have different material and structural requirements than those for electronics. Therefore, one of ordinary skill in the art would have had no reason to combine Taboas and Zakhidov, as the references mention structures for addressing unrelated problems in non-analogous technical fields.

Nevertheless, even if combined, Taboas and Zakhidov together fail to provide the necessary, specific teaching sufficient for one skilled in the art to somehow derive Applicants' claimed methods. Taboas, like Zakhidov, fails to remotely suggest methods for infiltrating any type of *shrunk* inverse replica or *shrunk* replica. Thus, one of ordinary skill in the art could not and would not have combined the references in the **particular manner required to arrive at** Applicants' claimed methods. The combination fails suggest a further step of infiltration of

Holland et al. is legally improper and factually inaccurate, since Zakhidov plainly adopts the teachings of Holland et al. by literal, express incorporation into the Zakhidov patent specification. Moreover, even if considered to be

the inverse *shrunk* replica as required by Applicants' claims 1, or to remove the immobilized material that comprises the bi- or multi-continuous structure of the inverse shrunk replica as required by Applicants' claim 3. The two references fail to teach that one could or should infiltrate a shrunk inverse replica, because Zakhidov's carbon shrunk inverse replica is incompatible with and inoperable for use in Applicants' claimed methods. Nothing in Taboas overcomes this deficiency with Zakhidov's teaching.

For these reasons, no *prima facie* case of obviousness of Applicants' claims has been established over Zakhidov in view of Taboas.

Zakhidov in Combination with Taboas and Narang

Narang is directed to the solid free form (SFF) fabrication of a three-dimensional object using a material that contains a metal covalently bonded to a nonmetal. In contrast, Zakhidov is directed to the creation of structures by infiltration and extraction. At Page 5 of the Office Action, the Examiner correctly notes that Zakhidov does not teach a structure formed by a solid freeform fabrication (SFF) process. The Office Action's remarks on Page 6 that Zakhidov and Narang "are combinable because they are concerned with a similar technical field, namely, SFF-directed structures," is thus illogical and unfounded.

Furthermore, one of ordinary skill in the art would have had no reason to combine Taboas and Narang. The references disclose structures for addressing unrelated problems in unrelated fields.

Even if Narang and Zakhidov were in the same technical field, one of ordinary skill in the art would not have combined the references in the **particular manner** required to derive

separate documents, together they form part of the prior art to be considered for all that they teach.

Applicants' claimed methods. The Examiner merely alleges that the reason one of ordinary skill in the would have had to derive the claimed invention is "to expand the field of application by providing electrical, thermal, and magnetic conducting paths within the bicontinuous structure." Given the myriad ways one might have expanded the field of application, the Examiner's so-called reasoning clearly fails to meet the legal threshold of particularity that is required to establish a *prima facie* case of obviousness.

Nevertheless, the three references fail to teach that one could or should infiltrate a shrunken inverse replica, because Zakhidov's carbon shrunken inverse replica is incompatible with and inoperable for use in Applicants' claimed methods. Neither Taboas nor Narang disclose anything to overcome this deficiency with Zakhidov's teaching.

No *prima facie* case of obviousness of Applicants' claims has been established over Zakhidov in view of Taboas in further view of Narang.

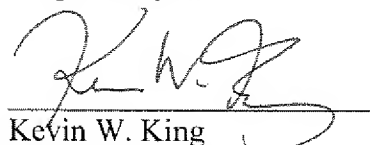
Conclusions

The cited prior art does not remotely suggest a process that includes making a shrunken inverse replica, infiltrating that shrunken inverse replica with a fluid material, and then immobilizing that fluid material, as set forth in Applicants' claims. Applicants submit that the claims are non-obvious over the prior art of record. Allowance of claims 1 and 3-44 is therefore respectfully submitted.

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RESPONSE TO OFFICE ACTION

The undersigned kindly invites the Examiner to contact him by telephone (404.853.8068) if any outstanding issues can be resolved by conference or examiner's amendment.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Kevin W. King', is written over a horizontal line.

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